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Inpatient Volume and Quality of Mental Health Care Among Patients With Unipolar Depression

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Objective: The relationship between inpatient volume and the quality of mental health care remains unclear. This study examined the association between inpatient volume of psychiatric hospital wards and quality of mental health care among patients with depression admitted to Danish hospitals.

Methods: In a nationwide population-based cohort study, 17,971 patients admitted to psychiatric hospital wards between 2011 and 2016 were identified from the Danish Depression Database. Inpatient volume was categorized into quartiles according to the individual ward's average caseload volume per year during the study period: low volume (quartile 1, <102 inpatients per year), medium volume (quartile 2, 102-172 inpatients per year), high volume (quartile 3, 173-227 inpatients per year) and very high volume (quartile 4, >227 inpatients per year). Quality of mental health care was defined as having fulfilled process performance measures of care reflecting national clinical guidelines recommendations.

Results: Compared with patients admitted to low-volume psychiatric hospital wards, patients admitted to very-high-volume wards were more likely to receive a high overall quality of mental health care (defined as fulfilling ≥80% of the process performance measures of care) (relative risk) [RR]=1.78, 95% confidence interval [CI]=1.02-3.09) as well as fulfilling individual process performance measures of care, including a somatic examination (RR=1.35, 95%CI=1.03-1.78).

Conclusion: Admission to very-high-volume psychiatric hospital wards was associated with a higher chance of receiving high quality care as reflected by a higher proportion of fulfilled guidelines supported process performance measures among patients admitted with depression.

INTRODUCTION

There is a growing interest in the association between inpatient volume and the quality of care, and the structure of the organization in the health care sector is a topic of discussion worldwide. The goal is to ensure better treatment quality, higher patient satisfaction and more efficiency (1). Several observational studies have examined the association for surgical procedures and various medical conditions. The evidence from these studies indicates that higher inpatient volume is associated with better clinical outcomes including reduced complications and lower mortality (2-5). Despite the increasing interest an analogous association between inpatient volume and the quality of mental health care has not been examined properly. To our knowledge, only six published studies have examined this association (1, 6-10). However, the results of these studies are inconsistent, making it difficult to draw conclusions. Furthermore, only one of the existing studies has examined the association specifically for patients with depression and there is a general lack of studies with detailed data regarding the quality of the provided mental health care (1, 6-10). To further assess the role of inpatient volume in mental health care, we conducted a nationwide population-based cohort study to examine the association between inpatient volume per psychiatric hospital ward and the quality of mental health care as reflected by the fulfilment of specific clinical guideline-based process performance measures of care among Danish patients admitted with depression.

METHODS

The Danish health care system is mainly tax-funded and provides health coverage free of charge (11). In particular, health equity is a stated priority, with equal reimbursement across all institutional levels. If psychiatric treatment is required, patients with depression can be admitted to public psychiatric hospitals, and their use of inpatient services is recorded in national registers with a ten-digit civil registration number, which is unique to each patient (12,13).

The Danish Depression Database

The Danish Depression Database was established with the objective to monitor, document and improve the quality of treatment and care among patients with depression and has been functional since 2011. It is mandatory by law for all Danish psychiatric hospital wards treating patients with depression to report data on all treated patients to the registry. The database holds data on process performance measures reflecting recommendations on care from national clinical guidelines (14-17). The following process performance measures of care are obtained on inpatients (Table 1): diagnosing depression, suicide risk assessment, family intervention and psychiatric aftercare. The registry also contains information on gender and age. The process performance measures are not necessarily causally linked with improved clinical outcomes, but reflect key recommendations from the national clinical guideline. The measures have been selected by an expert panel consisting of psychiatrists, psychologist, nurses, occupational therapists and social workers from the national clinical guideline (15,17). The data are collected prospectively and in accordance with the documentation recorded in the medical records by using a registration form with detailed instructions. The process performance measures of care for inpatients with depression are continuously registered during the hospitalization by the health care professionals responsible for the care of the individual patient (16).

Of the 21 processes of care monitored by the Danish Depression Database, nine are relevant to inpatients (15,17).

Study Population

The study population included all patients aged 18 and older, admitted with unipolar depression as a primary diagnosis and registered in the Danish Depression Database between January 1, 2011, and December 31, 2016. Depression was defined according to the ICD-10 (codes F32.0 to F32.99, F33.0 to F33.99, F34.1 and F06.32) (18). A total of 18,389 patients were identified. The patients were admitted to 94 different psychiatric hospital wards with 24,395 admissions during the study period. However, we only included the first recorded admission in each calendar year per patient at each psychiatric hospital ward since readmissions are not assumed to be similar with the same number of one-time admissions of several patients. We excluded hospitals wards with less than 20 recorded admissions during the entire study period, corresponding to 418 patients. This exclusion was made because hospital wards with only sporadic admissions were potentially more likely to have inadequate routines for reporting data to the Danish Depression Database.

Psychiatric Hospital Wards

The inpatient volume was defined as the average number of admissions to each psychiatric hospital ward per year from 2011 to 2016, on the basis of the entire study population, including 17,971 patients with 21,120 admissions. The inpatient volume was divided into four quartiles and referred to in this study as low volume (quartile 1, <102 inpatients per year), medium volume (quartile 2, 102-172 inpatients per year), high volume (quartile 3, 173-227 inpatients per year) and very high volume (quartile 4, >227 inpatients per year).

Statistical Analyses

The quality of mental health care was measured by the fulfilment of process performance measures of care by each patient, and was assessed both overall and for the individual process performance measures. The overall quality of care was calculated by dividing the number of fulfilled process performance measures by the number of relevant process measures for the individual patient. The association between inpatient volume and the quality of mental health care – the overall quality of care as well as the individual process performance measures – was examined using binomial regression while adjusting for gender and age. Information on other patient- or hospital related covariates were not available. The association between inpatient volume and the overall quality was examined by setting a pragmatic cut point of 80%; high overall quality of care was defined as a patient's receipt of 80% or more of all relevant recommended process performance measures. The Wald test was used to test for trend across the quartiles of inpatient volume. The analysis was also repeated with alternative cut points varying from 60% to 90%. The association was likewise examined for the excluded hospital wards and patients with a non-response in a sensitivity analysis. A number of additional analyses were performed to examine the robustness of the primary analysis: First, inpatient volume was examined as a continuous variable. Secondly, a multinomial logistic regression was used to examine the association between inpatient volume and the quality of mental health, with the quality of mental health care defined as 0-50%, >50-70%, >70-90% and >90%. Thirdly, an analysis performed based on the number of unique patients rather than the number of admissions. In this analysis, we excluded patients from 2011 to ensure a minimum wash-out period of previous admissions of 12 months.

All 95% confidence intervals [CI] were corrected for clustering of patients within psychiatric hospital wards by using robust estimates of the variance. The analyses were adjusted and stratified according to gender and age. A two-sided p value of $\leq .05$ was considered significant.

RESULTS

Characteristics of patients did not vary substantially across the quartiles of inpatient volume. Most patients were older than 60 years and the majority was women. On the overall quality of care by inpatients quartile, shown as the proportion of relevant process performance measures received by the patients, the largest proportion of patients was in the group receiving 0% to 20% of the relevant recommended process performance measures. The proportion of patients receiving ≥80% of the recommend process performance measures varied between 11.8% and 21.0%. The association between inpatient volume and the overall quality of care are presented in Table 2. Patients admitted to very-high-volume psychiatric hospital wards had a gender- and age adjusted relative risk (RR) of 1.78 (95% CI=1.02; 3.09) for receiving high overall quality of care (≥80% of the relevant recommended process performance measures) compared to patients admitted to low-volume wards. The test for trend across the inpatient volume categories did not reach statistical significance (p=0.11) (Table 2). When alternative cut points were used, the association was likewise confirmed for 90%, with RR for overall quality of care 2.02 (95% CI=1.03; 3.97) when very-high-volume wards were compared with low-volume wards. No statistical significant association was found when treating inpatient volume as a continuous variable (p=0.12). Table 3 presents data on the use of the nine individual process performance measures by inpatient volume quartiles. The proportion of patients fulfilling the individual process performance measures is low and varied from 18% to 66%. Only 35% to 44% of patients are seen by a psychiatrist within 7 days and only half the patients receive a suicide risk assessment at admission and discharge. Likewise only about 40% have planned psychiatric aftercare. The association between inpatient volume and the individual process performance measures are presented in Table 4. Patients admitted to low-volume psychiatric hospital

wards were in general less likely to have received care fulfilling the individual process performance measures, however not all associations reached statistical significance. Patients admitted to very-high-volume wards had a gender- and age adjusted RR 1.35 (95% CI=1.03; 1.78) for being somatically examined compared to those admitted to low-volume wards. In addition, a multinomial logistic regression demonstrated that admission to very high volume hospitals was associated most strongly with the highest level of quality of care (i.e., more than 90% of the process performance measures fulfilled). Hence, admission to at very high volume hospital was associated with an adjusted RR of 1.11 (95% CI=.68-1.83) for receiving a care fulfilling >50-70% of the process performance measures, whereas the adjusted RR for fulfilling >90% of the process measures was 2.39 (95% CI=1.00-5.69). Thus, the difference between high and low volume hospitals with regards to quality of care was most pronounced with regards to the chance of receiving optimal/near optimal quality of care.

We found no evidence of systematic interaction when the analyses stratified patients according to gender and age. In addition, the findings from the primary analysis were confirmed when performing an analysis based on the volume of unique patients at the individual hospitals during the study period (data not shown). The non-response analysis showed that the characteristics for the 418 excluded inpatients were distributed in the same way as the included patients. For the overall quality of care only 5.5% received ≥80% of the recommended process performance measures while 72% received 0-20%.

DISCUSSION

Our results show a small but statistical significant association between inpatient volume and quality of mental care among patients with depression. When patients with depression were admitted to very-

high-volume wards, they were more likely to receive high overall quality of care as reflected by fulfilment of process performance measures, including an somatically examination and an assessment by a social worker. However, the quality of mental health care did not increase statistically significantly with a continuous increase in inpatient volume. No clear associations were found for the remaining processes of care. The differences in care between hospitals above the lowest patient volume category were small or non-existing and the findings may therefore imply that low-volume psychiatric hospital wards are challenged with delivering optimal care for inpatients with depression – at least in some areas of care.

Strengths and Limitations

The study strengths include prospectively collected data, a relatively large study population, and a nationwide population-based design. The Danish Depression Database has high coverage, i.e., in 2015 it was estimated to include records for 100% of all inpatients with depression in the Danish psychiatric health care system (19). The risk of confounding is a concern in our study as in any observational study. The only available covariates in the database were gender and age, and residual and unaccounted confounding from other patient- or hospital related variables can therefor not be excluded. However, it should be noted that the included process performance measures of care in principle are relevant for all patients with depression regardless of their characteristics and independent of inpatient volume.

Validity of the data is always a relevant concern in registry-based studies. The data in the Danish Depression Database are collected by a large number of clinicians during routine clinical work, and registration errors and variation in registration practice can occur. Extensive efforts, however, are made to ensure data validity and uniformity by detailed instructions, with explicit data definitions,

standardized registration forms and systematic structured audit processes conducted on a local, regional and national basis. The audit processes evaluate the quality of the data and provide feedback to the psychiatric hospital wards (15,19). Moreover, the quality of care was simplified because of the dichotomous data. In a clinical setting, variations may occur in delivering processes to patients but detailed instructions included in the registration forms are intended to reduce such differences. In this study, hospital wards with less than 20 recorded admissions during the study period were excluded, which can be a limitation since the objective was to examine the association between inpatient volume per psychiatric hospital ward and the quality of mental health care. We did however conduct a non-response analysis, which confirmed the association found in the main analyses. Furthermore, the process performance measures in this study have not been shown to be directly associated with clinical outcome and may not necessarily apply to other countries or patient populations. However, the measures do reflect recommendations from a national expert panel and are in line with similar standards of care used in other comparable health care systems (20).

Comparison With Other Studies

Among the few existing studies on the topic is a Danish study, which examined the relationship between admission volume per ward per year and quality of mental health care among Danish patients with recently diagnosed schizophrenia (1). The quality of care was also here defined as fulfilment of processes of care reflecting the national guidelines. The study found that patients admitted to very-high-volume psychiatric hospital wards were 1.40 times more likely than patients admitted to low-volume wards to receive high overall quality of care (≥80% of the relevant recommended processes). Furthermore, patients admitted to very-high-volume psychiatric hospital wards were more likely to receive several of the individual processes. A U.S. study has examined the relationship between

inpatient volume per ward and five mental health care quality measures (8). This study measured the quality of care by seven-day and 30-day follow-up after hospitalization for mental illness, the management of antidepressant medication by prescriptions filled during a 12-week period and for at least six months, and at least three follow-up visits in the 12 weeks after diagnosis of a new episode of depression. For all five measures, patients admitted to wards with a low inpatient volume received poorer quality of care than those admitted to wards with high inpatient volume. Other studies have examined the relationship between inpatient volume per psychiatrist and the quality of mental health care by length of stay and readmission (6,7,9,10). The studies found that high inpatient volume per psychiatrist was associated with both a shorter stay and a higher readmission rate. However, increased length of stay and readmissions do not necessarily indicate poor-quality mental health care. If a psychiatric patient is severely ill or psychotic an extended stay may be required, and readmissions may be essential for stabilization of the patient.

In this study, we examined inpatient volume defined as the average number of inpatients in each psychiatric hospital ward per year from 2011 to 2016. This measure reflects the experience and capacity of an organization and not of an individual psychiatrist. Other studies have examined the provider-level volume, defined as the total number of mental health inpatients by a given psychiatrist (6,7,9,10). The inpatient volume per psychiatrist used in these studies reflects the experience of the individual psychiatrist rather than the organization within which the psychiatrist works as used in our study.

Underlying mechanisms in high-volume psychiatric hospital wards, such as specialization, greater clinical experience and better resources, might explain the observed association between very-high volume psychiatric hospital wards and the highest overall quality of care for patients with depression.

Furthermore, a greater number of beds and shorter stays may characterize high-volume psychiatric hospital wards.

Based on the results of this study, it is not possible to estimate whether there is an upper limit for how much inpatient volume a psychiatric hospital ward should have. We cannot automatically assume that bigger is always better as hospitals with very high patient volume may also encounter other challenges, e.g. insufficient resources and communication difficulties within a very large staff group. This scenario is also illustrated by another Danish study of hip fracture ward volume. This study found that patients admitted to high-volume hip fracture wards had higher mortality rates, received a lower quality of in-hospital care, and had longer length of hospital stay (21).

We encourage further studies of the association between inpatient volume and quality of care to confirm the generalizability of our findings for specific mental disorders, including depression. A final question remains about the cost-effectiveness of qualified diagnosis, treatment and care in very-high-volume psychiatric hospital wards. The cost of providing higher-quality care, health consequences and specific short- and long-term costs need to be clarified.

CONCLUSIONS

This nationwide population-based cohort study demonstrated that patients with depression who were admitted to very-high-volume psychiatric hospital was associated with a higher chance of receiving care according to clinical guidelines. Still, for most of the examined process performance measures the absolute differences were modest, and further studies are necessary to determine the clinical implications of the possible differences in care.

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TABLE 1. Definitions of nine process performance measures for inpatients with depression

Care process	Definition
Examination by psychiatrist	Indication of whether the patient's psychopathological assessment was performed by a specialist in psychiatry within 7 days after admittance to the hospital ward.

Somatic examination	Neurological examination, relevant laboratory tests and other examinations within 2 days.
Assessment by a social worker	Assessment of need for acute or longer-term support, such as help with changing housing, financial help to purchase medicine, educational guidance, rehabilitation, and application for disability benefits.
HAM-D17[a] assessment (I)	Initial assessment using HAM-D17 within 7 days.
HAM-D17 assessment (II)	Assessment using HAM-D17 at discharge from hospital.
Suicide risk assessment (I)	Using structured interview at admittance.
Suicide risk assessment (II)	Clinician's assessment of the patient's risk of suicide when discharge from hospital is planned.
Contact with relatives	Staff contact with the patient's relatives during hospitalization.
Psychiatric aftercare	Concrete agreement involving professional support for inpatients after discharge.

[a] Hamilton Depression Scale (HAM-D17)

TABLE 2. Association between psychiatric ward inpatient volume and quality of mental health care among patients with depression

Inpatient volume[a]	Total inpatients	Received high-quality care (%)[b]	RR[c]	95% CI

Medium	4,870	16	1.37	.76-2.46
High	5,336	19.6	1.72	.80-3.69
Very high	5,337	21	1.78	1.02-3.09

[a] Reference group, low inpatient volume. Low volume, <102 inpatients per year; medium volume, 102-172; high volume, 173-227; and very high volume >227

[b] Received 80%-100% of relevant recommended process performance measures

[c] Adjusted for gender and age

TABLE 3. Fulfilment of nine process performance measures by patients with depression, by psychiatric ward inpatient volume[a]

	Low volume		Medium volume		High volume		Very high volume	
Care process	N	%	N	%	N	%	N	%
Examination by psychiatrist	5,380	100	4,632	100	5,245	100	5,144	100
No	3,474	65	2,863	62	3,077	59	2,866	56
Yes	1,906	35	1,769	38	2,168	41	2,278	44
Somatic examination	5,557	100	4,859	100	5,320	100	5,326	100
No	3,210	58	2,616	54	2,737	51	2,299	43
Yes	2,333	42	2,243	46	2,583	49	3,027	57
Assessment by a social worker	5,557	100	4,860	100	5,330	100	5,326	100
No	3,999	72	3,421	70	3,117	58	3,220	60
Yes	1,558	28	1,439	30	2,213	42	2,106	40
HAM-D17[b] assessment (I)	5,431	100	4,488	100	5,212	100	5,063	100
No	4,107	76	3,290	73	3,314	64	3,513	69
Yes	1,324	24	1,198	27	1,898	36	1,550	31

HAM-D17 assessment (II)	5,276	100	4,271	100	5,155	100	4,849	100
No	4,220	80	3,504	82	3,669	71	3,736	77
Yes	1,056	20	767	18	1,486	29	1,113	23
Suicide risk assessment (I)	5,577	100	4,870	100	5,336	100	5,337	100
No	2,843	51	2,291	47	1,806	34	2,237	42
Yes	2,734	49	2,579	53	3,530	66	3,100	58
Suicide risk assessment (II)	5,557	100	4,860	100	5,330	100	5,326	100
No	3,015	54	2,646	54	2,374	45	2,643	49.6
Yes	2,542	46	2,214	46	2,956	55	2,683	50.4
Contact with relatives	5,168	100	4,401	100	5,075	100	4,933	100
No	3,213	62	2,793	63	2,349	46	2,824	57
Yes	1,955	38	1,608	37	2,726	54	2,109	43
Psychiatric aftercare	5,397	100	4,608	100	5,229	100	4,987	100
No	3,286	61	2,717	59	2,894	55	2,633	53

Yes	2,111	39	1,891	41	2,335	45	2,354	47

[a] Low volume, <102 inpatients per year; medium volume, 102-172; high volume, 173-227; and very high volume >227

[b] Hamilton Depression Scale (HAM-D17)

TABLE 4. Association between psychiatric ward inpatient volume and fulfilment of nine process performance measures by patients with depression[a]

Care processes and inpatient volume	Total inpatients	Percentage receiving the care process	RR[b]	95% CI
Examination by psychiatrist				
Medium	4,632	38	1.08	.74-1.57
High	5,245	41	1.17	.76-1.79
Very High	5,144	44	1.25	.95-1.64
Somatic examination				
Medium	4,859	46	1.09	.81-1.49
High	5,320	49	1.15	.85-1.57
Very high	5,326	57	1.35	1.03-1.78
Assessment by a social worker				
Medium	4,860	30	1.06	.70-1.59
High	5,330	42	1.48	.93-2.35
Very High	5,326	40	1.41	.99-2.01

HAM-D17[c] assessment (I)				
Medium	4,488	27	1.09	.71-1.69
High	5,212	36	1.49	.94-2.38
Very high	5,063	31	1.26	.82-1.92
HAM-D17 assessment (II)				
Medium	4.271	18	.89	.53-1.52
High	5,155	29	1.44	.81-2.57
Very high	4,849	23	1.15	.65-2.02
Suicide risk assessment (I)				
Medium	4,870	53	1.08	.74-1.58
High	5,336	66	1.35	.93-1.95
Very high	5,337	58	1.18	.87-1.62
Suicide risk assessment (II)				
Medium	4,860	46	.99	.70-1.42
High	5,330	55	1.21	.85-1.73
Very high	5,326	50	1.10	.81-1.49
Contact with relatives				
Medium	4,401	37	.97	.65-1.44
High	5,075	54	1.42	.96-2.09

Very high	4,933	43	1.13	.81-1.57
Psychiatric aftercare				
Medium	4,608	41	1.05	.68-1.62
High	5,229	45	1.14	.71-1.85
Very high	4,987	43	1.21	.86-1.71

[a] Reference group, low inpatient volume. Low volume, <102 inpatients per year; medium volume, 102-172; high volume, 173-227; and very high volume >227

[b] Adjusted for gender and age

[c] Hamilton Depression Scale (HAM-D17)